🛡️ Technical Report – Networking and Cybersecurity

Cisco Packet Tracer Lab: VLAN, DHCP, NAT, and Internet Simulation

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- 🔹 Project: Complete Configuration of a Simulated Enterprise Network
- 🔹 Lab File: vlan-dhcp-nat.pkt

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1. Introduction

In this lab, I wanted to build a real small business network.

Not just connect cables, but really understand how a well-structured network works: with VLANs, a DHCP server, routing between networks, and even a simulated Internet access.

I did this in Cisco Packet Tracer, a very useful tool for learning how to configure Cisco equipment, such as routers and switches.

My goal was simple:

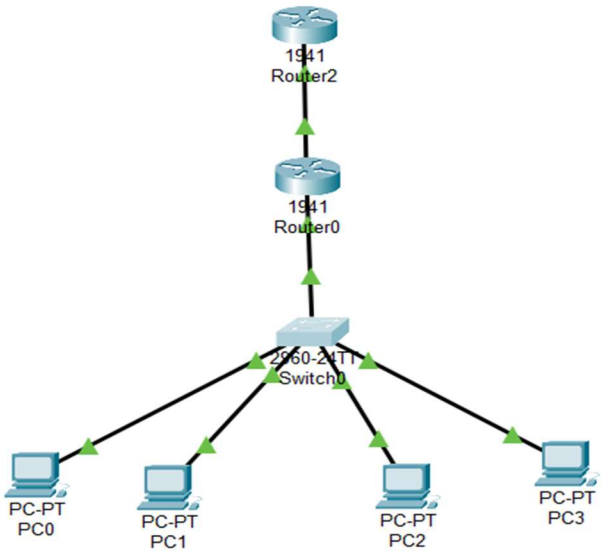
Even someone who has never done networking before should be able to follow this guide and pass the lab.

2. Materials used

- 1 switch (Cisco 2960) : 
- 2 routers (Router0 and Router1): 
- 4 PC (PC0 à PC3) : 
- Wiring Copper Straight-Through : 
- Software : Cisco Packet Tracer

3. The network plan (topology)

This is what the network looks like in the lab:



- PC0 and PC1 are in VLAN 10 (Administration)
- PC2 and PC3 are in VLAN 20 (Students)
- Router0 connects the VLANs together and provides Internet access
- Router1 acts as the Internet provider (such as Bell, Rogers, etc.)

4. Setup Steps:

4.1: Create VLANs

On the switch, create two VLANs: one for Admins and one for Students.

```
Switch#
Switch#
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name ADMIN
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name STUDENT
Switch(config-vlan)#exit
```

4.2: Associate the switch ports with the correct VLANs

Ports fa0/1 and fa0/2 → VLAN 10 (PC0 and PC1)

Ports fa0/3 and fa0/4 → VLAN 20 (PC2 and PC3)

```
Switch(config)#interface range f0/1 - 2
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit
Switch(config)#interface range f0/3 - 4
Switch(config-if-range)#swichport mode access
                       ^
```

4.3: Create the trunk to the router

The switch's port fa0/5 must be able to carry all VLANs to Router0:

```
Switch(config)#interface f0/5
Switch(config-if)#switchport mode trunk
Switch(config-if)#
```

4.4: Router0 Configuration

a) Inter-VLAN Routing

We will create two subinterfaces on the router's G0/0 port to communicate with each VLAN:

```
Router>
Router>enable
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface g0/0
Router(config-if)#no shutdown

Router(config)#interface g0/0.10
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10, changed state to up

Router(config-subif)#encapsulation dot1q 10
Router(config-subif)#ip address 192.168.10.1 255.255.255.0
Router(config-subif)#exit
Router(config)#interface g0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.20, changed state to up

Router(config-subif)#encapsulation dot1q 20
Router(config-subif)#ip address 192.168.20.1 255.255.255.0
Router(config-subif)#exit
```

b) Enable a DHCP server

The router will act as an automatic IP server (like a Wi-Fi router at home).

```
Router(config)#ip dhcp pool vlan10
Router(dhcp-config)#network 192.168.10.0 255.255.255.0
Router(dhcp-config)#default-routeur 192.168.10.1
                                   ^
% Invalid input detected at '^' marker.

Router(dhcp-config)#default-router 192.168.10.1
Router(dhcp-config)#dns-server 8.8.8.8
Router(dhcp-config)#
Router(dhcp-config)#exit
Router(config)#ip dhcp pool vlan20
Router(dhcp-config)#network 192.168.20.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.20.1
Router(dhcp-config)#dns-server 8.8.8.8
Router(dhcp-config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to down
```

5. Configure NAT (to access the Internet)

a) Give a public IP to the router (g0/1)

```
Router(config)#interface g0/1
Router(config-if)#ip address 203.0.113.1 255.255.255.0
Router(config-if)#ip nat outside
Router(config-if)#
```

```
Router(config)#interface g0/0.10
Router(config-subif)#ip nat inside
```

→ This subinterface is for VLAN 10 → Admin network.

```
Router(config-subif)#interface g0/0.20
Router(config-subif)#ip nat inside
```

→ This one is for VLAN 20 → Student network.

At this point, I clearly stated that all LAN interfaces are "inside."

b, Define the external interface (the one that goes to the Internet)

```
Router(config-subif)#interface g0/1
Router(config-if)#ip nat outside
Router(config-if)#exit
```

→ I specified that this interface is the exit to the (public) Internet.

c, Creating the ACL (access list)

```
Router(config)#access-list 1 permit 192.168.10.0 0.0.0.255
Router(config)#access-list 1 permit 192.168.20.0 0.0.0.255
```

→ This means that you allow the 192.168.x.x range (so 192.168.10.0, 192.168.20.0, etc.) to use NAT.

d, Active NAT Overload (PAT)

```
Router(config)#ip nat inside source list 1 interface g0/1 overload
```

6. Configure Router1 (Internet simulator)

```
Router>enable
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface g0/0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

Router(config-if)#ip address 203.0.113.2 255.255.255.0
Router(config-if)#exit
```

Router1 is configured with a static IP and acts as the default gateway to simulate Internet access.

7. Tests performed

Test	**Result**
Each PC receives an IP	✅ Yes
Ping between VLAN 10 and VLAN 20	✅ Yes
Ping to 203.0.113.2 (Internet)	✅ Yes
show ip nat translations	✅ OK

8. Conclusion

This lab allowed me to see how a real network is built:

- A switch with multiple VLANs
- A router that manages internal communications
- A built-in DHCP server to distribute addresses
- A simulated Internet connection, with control via NAT

This is exactly what you'd find in a small business.

Although it's a simple lab, it covers many of the basics of network cybersecurity:

✅ segmentation, ✅ access control, ✅ address translation, ✅ IP management.